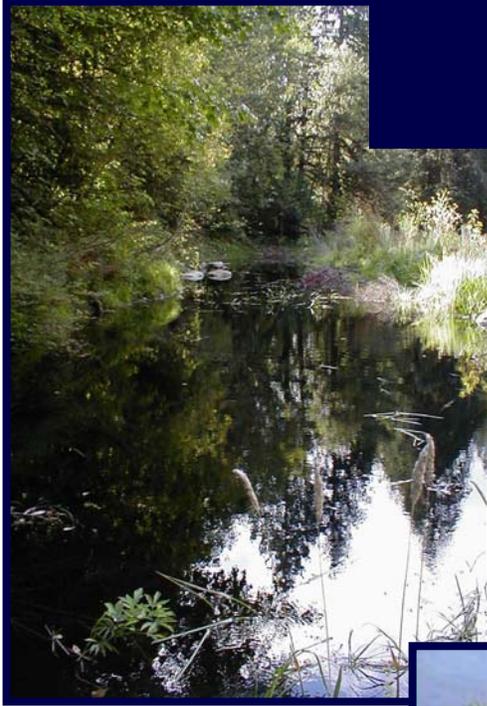


# Lower Columbia Salmon Recovery And Fish & Wildlife Subbasin Plan



Restoring Salmon And Steelhead  
To Healthy, Harvestable Levels



Clark, Cowlitz, Lewis, Skamania  
And Wahkiakum Counties



## PLAN OVERVIEW

Lower Columbia Fish Recovery Board  
December 15, 2004



# Lower Columbia Salmon Recovery And Fish & Wildlife Subbasin Plan

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## PLAN OVERVIEW

Lower Columbia Fish Recovery Board

December 15, 2004

The Lower Columbia Fish Recovery Board unanimously adopts  
The Lower Columbia Salmon Recovery and Fish and Wildlife Subbasin Plan

*With the understanding that*

Implementation of the schedule and actions for local jurisdictions

Depends upon funding and other resources;

APPROVED THIS 10<sup>th</sup> DAY OF DECEMBER 2004.

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## *Preface*

This is one in a series of volumes that together comprise a Recovery and Subbasin Plan for Washington lower Columbia River salmon and steelhead:

--	Plan Overview	<i>Synopsis of the planning process and regional and subbasin elements of the plan.</i>
Vol. I	Regional Plan	<i>Regional framework for recovery identifying species, limiting factors and threats, the scientific foundation for recovery, biological objectives, strategies, measures, and implementation.</i>
Vol. II	Subbasin Plans	<i>Subbasin vision, assessments, and management plan for each of 12 Washington lower Columbia River subbasins consistent with the Regional Plan. These volumes describe implementation of the regional plan at the subbasin level.</i>  <i>II.A. Lower Columbia Mainstem and Estuary</i> <i>II.B. Estuary Tributaries</i> <i>II.C. Grays Subbasin</i> <i>II.D. Elochoman Subbasin</i> <i>II.E. Cowlitz Subbasin</i> <i>II.F. Kalama Subbasin</i> <i>II.G. Lewis Subbasin</i> <i>II.H. Lower Columbia Tributaries</i> <i>II.I. Washougal Subbasin</i> <i>II.J. Wind Subbasin</i> <i>II.K. Little White Salmon Subbasin</i> <i>II.L. Columbia Gorge Tributaries</i>
Appdx. A	Focal Fish Species	<i>Species overviews and status assessments for lower Columbia River Chinook salmon, coho salmon, chum salmon, steelhead, and bull trout.</i>
Appdx. B	Other Species	<i>Descriptions, status, and limiting factors of other fish and wildlife species of interest to recovery and subbasin planning</i>
Appdx. C	Program Directory	<i>Descriptions of federal, state, local, tribal, and non-governmental programs and projects that affect or are affected by recovery and subbasin planning</i>
Appdx. D	Economic Framework	<i>Potential costs and economic considerations for recovery and subbasin planning</i>
Appdx. E	Assessment Methods	<i>Methods and detailed discussions of assessments completed as part of this planning process</i>

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## VISION

*It is the vision of this plan to:*

- *Recover Washington lower Columbia salmon, steelhead, and bull trout to healthy, harvestable levels that will sustain productive sport, commercial, and tribal fisheries through the restoration and protection of the ecosystems upon which they depend and the implementation of supportive hatchery and harvest practices; and*
- *Sustain and enhance the health of other native fish and wildlife species in the lower Columbia through the protection of the ecosystems upon which they depend, the control of non-native species, and the restoration of balanced predator/prey relationships.*

This is a plan for the protection and restoration of native fish, aquatic habitats, and sensitive wildlife species in Washington lower Columbia River subbasins. It serves as 1) a recovery plan for Washington lower Columbia salmon and steelhead populations and 2) a Northwest Power and Conservation Council Fish and Wildlife Plan for eleven lower Columbia subbasins.

The plan is the product of a collaborative process facilitated by the Lower Columbia Fish Recovery Board (LCFRB) and involving federal and state agencies, tribes, local governments, and the public. It recognizes that recovery of fish and wildlife is a shared responsibility and can only be achieved through the cooperative and combined efforts of federal, tribal, state, and local interests. In order to ensure consistency in goals, strategies and actions and to eliminate needless duplication of effort, the process integrated planning for Federal Endangered Species Act (ESA) recovery, Northwest Power and Conservation Council (NPCC) fish and wildlife program, and Washington State watershed management and salmon recovery.

Recovery of fish and enhancement of wildlife cannot be accomplished by addressing a single threat or limiting factor. It requires a comprehensive approach that addresses the needs of each species throughout their life history. It must work for fish and wildlife and the people of the region. This plan provides a roadmap for recovery. It melds science and biology with cultural, social, and economic considerations. The plan sets forth a “directional” approach based on objectives, strategies, measures and actions needed to address the full range of threats as they are currently understood. The aim is to reverse long term declining trends and establish a trajectory leading to recovery within 25 years. Since existing information is too uncertain to prescribe the exact course to recovery, progress will be evaluated regularly and, where necessary, the course adjusted.

Implementation of the plan will be achieved through a regional partnership of local, state, federal and tribal interests. The plan is not a regulatory document. It does not obligate any party but does establish specific responsibilities for actions that have been identified as important to fish recovery. It focuses on achieving outcomes and allows implementing agencies and other entities the flexibility to craft innovative, yet scientifically sound, approaches that best fit local conditions and values. Recovery partners will be asked to commit implementation through a six-year implementation schedule.

## INTRODUCTION

This plan describes:

- A vision for recovery of salmon, steelhead, and bull trout, and the ecosystems upon which they depend, and for the protection and enhancement of other fish and wildlife species.
- An overview of the planning process.
- A description of fish and wildlife species of interest.
- A summary of the limiting factors and threats to these species.
- An explanation of the scientific foundation for recovery
- Recovery goals consistent with the vision.
- Regional strategies and measures for achieving recovery goals.
- Detailed monitoring and research plans.
- A framework for plan implementation including an institutional structure, adaptive management strategy, and list of actions and responsibilities.
- Detailed assessments of species status, limiting factors, and threats in each subbasin.
- Actions for implementing strategies and measures in each subbasin.
- Descriptions of Federal, state, and local programs that play a role in implementation.
- Extensive documentation of related information on species and assessment methods.

This is a third draft of this plan. It includes revisions incorporated following extensive review and comment by involved and interested parties and the public through an inclusive and transparent planning process.

### Plan Organization

**Volume I** – A Regional Plan describes a comprehensive framework for recovery that considers local and regional contexts and tradeoffs.

**Volumes II.A-II.L** – A series of Subbasins Plans describe local conditions and detail implementation of the regional plan at the subbasin level.

**Appendices A-E** – Provide additional detail on focal species, other species, related programs, economic considerations, and assessment methods.

### An Integrated Plan

The planning process integrates four interrelated initiatives to produce a single Recovery/Subbasin Plan for the lower Columbia:

- U.S. Endangered Species Act recovery planning for listed salmon, steelhead and trout.
- Northwest Power and Conservation Council (NPCC) subbasin planning for eight full and three partial subbasins which guides Bonneville Power Administration's funding of projects to implement the fish and wildlife program.
- Watershed planning pursuant to the Washington Watershed Management Act, RCW 90.82.
- Habitat protection and restoration pursuant to the Washington Salmon Recovery Act, RCW 77.85.

This integrated approach ensures consistency and compatibility of goals, objectives, strategies, priorities and actions; eliminates redundancy in the collection and analysis of data; and establishes a partnership of federal, state, tribal and local governments under which agencies can effectively and efficiently coordinate planning and implement actions.

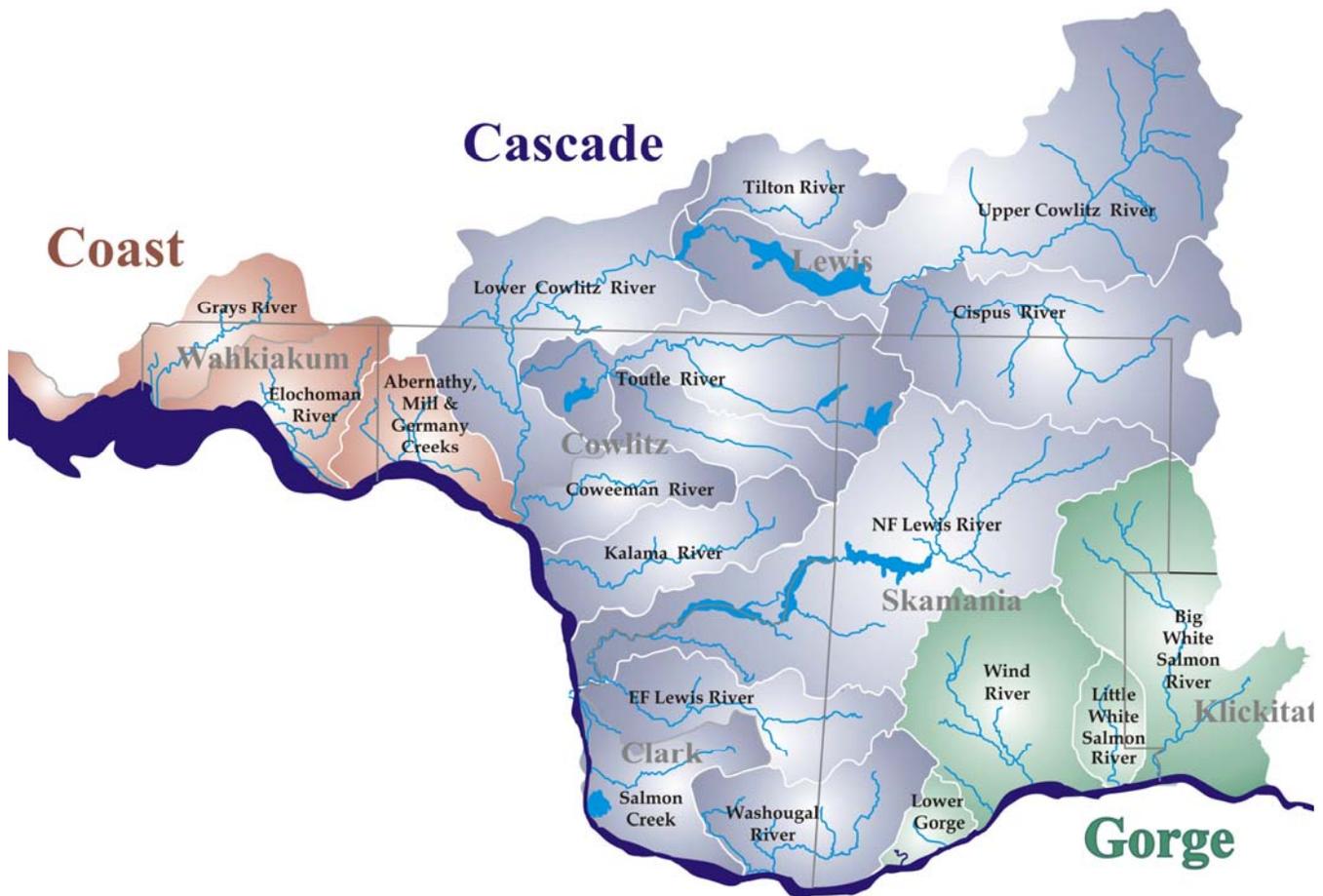
### Planning Area

The planning area includes all Washington Columbia River subbasins from the Chinook River near the ocean to and including the Little White Salmon River in the gorge, as well as the Washington portion of the estuary and mainstem up to the Little White Salmon River.

### Planning Horizon

The Plan uses a planning period of 25 years. The goal is to fully implement within this time period all actions needed to achieve recovery of salmon, steelhead, and bull trout and the biological objectives for other fish and wildlife species of interest. It is recognized, however, that full realization of habitat conditions and watershed process needed to reach the healthy and harvestable goals of this plan will likely take 75 years or more.

- Planning Area Features**
- 5,700 square miles
  - 1,700 river and stream miles
  - Almost half a million people
  - All of Clark, Cowlitz, Skamania, and Wahkiakum Counties and portions of Lewis and Pacific Counties.
  - 13 cities as well as numerous unincorporated communities.
  - Lands of interest to Yakama Indian Nation and the Cowlitz and Chinook tribes where reserved fishing and hunting rights are exercised, natural resources are co-managed, and tribal trust lands are inhabited.



## Planning Organization & Participants

The LCFRB led and coordinated the development of the Plan. The Board was established by state statute (RCW 77.85.200) in 1998 to oversee and coordinate salmon and steelhead recovery efforts in the lower Columbia region of Washington. It is comprised of representatives from the state legislature, city and county governments, the Cowlitz Tribe, private property owners, hydro project operators, the environmental community, and concerned citizens. A variety of partners representing federal agencies, Tribal Governments, Washington state agencies, regional organizations, local governments, and members of the public participated in the planning process. Participation was achieved through a steering committee, work groups, watershed planning units, and public meetings, workshops, and comment periods.

## Community and Public Participation

The planning process involved a series of work groups and additional opportunities for community and public participation. These included:

- Numerous presentations made to agencies, local governments, groups, and organizations regarding recovery issues and the planning process.
- A 30-day public comment period and a series of workshops on the Plan's Technical Foundation.
- "Scenario Evaluation Team" meetings which brought together agency personnel, citizens, economic interests, timber companies, local government officials, and non-profit organizations to discuss plausible recovery scenarios.
- Four stakeholders workshops to review and comment on regional strategies and measures.
- A 60-day public comment period on the draft plan in conjunction with the NPCC subbasin plan review process.

A 30-day public comment period and workshops on the second draft of the plan, which was revised based on comments received on the earlier draft.

## SPECIES ADDRESSED

The primary focus is on salmon, steelhead and trout species listed or proposed for listing under the ESA. A wide variety of other fish and wildlife species will also benefit from the plan's ecosystem approach to salmonid recovery, and the plan identifies other fish and wildlife species that will be affected by salmon recovery or hydrosystem mitigation actions.

Species addressed by this plan are categorized as follows:

***Focal Species*** – Salmon, steelhead, and trout that are listed or proposed for listing under the ESA received the highest level of attention in this plan.

***Other Sensitive Species*** – Other state or federally-listed threatened or endangered species that may be affected by salmon recovery actions or hydro system construction and operations.

***Species of Ecological Interest*** – Species that are important from a management perspective or are related to the general health of the subbasins in terms of environmental quality or habitat diversity.

***Species of Recreational Interest*** – Non-native species of primarily of recreational interest.

This plan is a primary instrument guiding protection, enhancement, and recovery of focal salmonid species. Other fish and wildlife species that are the subject of other management plans and processes are treated in less detail than focal species.



**Chum salmon in spawning colors**

### Focal Species

**Chinook salmon.**– Spring, tule Fall, and bright fall runs were included in the Lower Columbia River evolutionarily significant unit (ESU) listed as a threatened species under the ESA on March 24, 1999.

**Chum salmon.**– The lower Columbia River chum ESU was listed as threatened on March 25, 1999.

**Steelhead.**– The Lower Columbia steelhead ESU was listed as threatened under the ESA on March 19, 1998. The Grays, Elochoman, Skamokawa, Abernathy, Mill, and Germany steelhead populations are in the Southwest Washington ESU and are not listed under the ESA but are addressed by this plan.

**Coho.**– Lower Columbia coho are proposed for ESA listing as threatened.

**Bull Trout.**– On June 10, 1998, the United States Fish and Wildlife Service (USFWS) listed bull trout in the Columbia and Klamath river basins as threatened under the ESA. Bull trout are also subject of a draft species recovery plan.

### Other Sensitive Species

- Bald Eagle
- Sandhill Crane
- Dusky Canada Goose
- Columbia Whitetail Deer
- Fisher
- Western Gray Squirrel
- Seals & Sea Lions
- Western Pond Turtle

- Oregon Spotted Frog
- Larch Mountain Salamander

### Species of Ecological Significance

- Cutthroat Trout
- White Sturgeon
- Green Sturgeon
- Eulachon (Smelt)
- Pacific Lamprey
- Northern Pikeminnow
- American Shad
- Band-tailed Pigeon
- Caspian Tern
- Osprey
- Yellow Warbler
- Red-eyed Vireo
- River Otter

### Species of Recreational Significance

- Walleye
- Smallmouth Bass
- Channel Catfish



**Caspian tern**

## LIMITING FACTORS & THREATS

Comprehensive descriptions of limiting factors and threats to focal species identify the reasons for species declines and potential avenues for recovery. All local and out-of-basin limiting factors and threats that might affect species during their life cycle are discussed. The relative magnitudes of manageable impacts are quantified where the data allows.

### Stream Habitat

Analysis suggests stream habitat productivity in the region have been degraded by 20-80% relative to “properly functioning” condition benchmarks for salmon, steelhead, and trout. Fish have been adversely affected by changes in access, stream flow, water quality, sedimentation, habitat diversity, channel stability, riparian conditions, and floodplain interactions. Corresponding threats include dams and other barriers, water withdrawals, urban and rural development, past forest practices, agriculture practices, mining, channel manipulations, and recreational activities. Detailed assessments of stream habitat conditions watershed conditions, and habitat forming processes may be found in subbasin volumes of the plan.

### Estuary and Mainstem Habitat

Estuary and lower Columbia mainstem habitats play an important but poorly understood role in the anadromous fish life cycle. Large-scale changes in river flow, water circulation, sediment transport, and floodplain and wetland destruction or isolation have altered habitat conditions and processes important to migratory and resident fish and wildlife. Hydro flow regulation, channel alternations, and floodplain development and diking have all contributed to these habitat changes. Estuary conditions and influences are described in detail in a subbasin volume of the plan.

### Definitions

**Limiting factors:** conditions that directly or indirectly affects a species’ numbers, productivity, distribution, or diversity through its influence on reproduction, growth, mortality, or migration.

**Threats:** specific human activities that affect limiting factors.

**Example:** stream flow would be a limiting factor and water withdrawal is a threat that affects stream flow.

**Implications:** threats are potentially manageable while limiting factors may also include things like ocean conditions that cannot be managed.

### Hydropower

Habitat conditions for fish and particularly anadromous fish have been fundamentally altered throughout the Columbia River basin by the construction and operation of a complex of tributary and mainstem dams and reservoirs for power generation, navigation, and flood control. Lower Columbia salmon, steelhead and trout are threatened by hydrosystem-related flow and water quality effects, obstructed and/or delayed passage; and ecological changes in impoundments. Dams in the Lewis, Cowlitz, and White Salmon subbasins have blocked access by anadromous fishes to large areas of productive habitat.



**Merwin Dam on the Lewis River**

## Harvest

Harvest of lower Columbia salmon and steelhead includes commercial, recreational, and tribal fisheries in the ocean from Alaska to northern California and in the mainstem Columbia and tributaries. Current fishing impact rates on wild salmon populations ranges from 2.5% for chum salmon to 45% for tule fall Chinook. Fisheries do not target weak listed salmon or steelhead populations but listed fish are incidentally caught in fisheries for hatchery and strong wild stocks.

## Hatcheries

Hatcheries currently release over 50 million salmon and steelhead per year in Washington lower Columbia River subbasins. Many of these fish are released to mitigate for loss of habitat resulting from the Columbia River hydrosystem and widespread habitat development. Hatcheries provide valuable mitigation and conservation benefits but may also cause significant adverse impacts if not prudently and properly employed.

Risks to wild fish include genetic deterioration, reduced fitness and survival, ecological effects such as competition or predation, facility effects on passage and water quality, mixed stock fishery effects, and confounding the accuracy of wild population status estimates.

## Ecological Interactions

Ecological interactions refer to the relationships of salmon and steelhead with other elements of the ecosystem. Limiting factors include interactions with non-native species, effects of salmon on system productivity (e.g. nutrient cycling), and native predators of salmon. Each of these factors can be exacerbated by human activities either by direct actions or indirect effects of habitat alternation.

## SCIENTIFIC FOUNDATION FOR RECOVERY

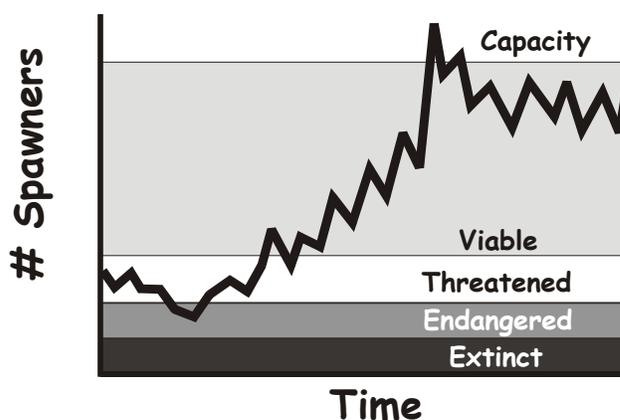
A strong scientific foundation is key to defining effective recovery objectives, regional strategies and measures, and subbasin restoration actions.

### Understanding Extinction & Recovery

Extinction typically refers to the irreversible disappearance of a species or, in the case of Pacific salmon, an Evolutionarily Significant Unit (ESU). Salmon ESU's are comprised of a series of unique populations that return to different areas of the ESU. Extinction results from the interaction of fish biology and external factors that reduce population size to critical low levels that are no longer self-sustaining over time.

The federal ESA qualifies extinction risks at two levels: endangered with extinction and threatened with becoming endangered. ESA delisting can occur at a point when listed species and their ecosystems are restored and their continued existence is assured to the point that protections under the ESA are no longer needed.

Decisions to delist are based on the species' biological status (biological de-listing criteria) and on the status of the threats to the species (threats criteria). ESA delisting does not require restoration of pristine system.



## Considering Biological & Social Values

This plan addresses biological recovery for salmon and steelhead populations and ESUs as well as goals related to direct and indirect uses of fish, water, and land resources. Considerations of both biological and social values are implicit in any definition of recovery goals.

## Characteristics of Healthy Species

Underlying biological characteristics are the ultimate determinants of population and ESU health. This plan incorporates NOAA Fisheries' Viable Salmonid Population (VSP) framework as a basis for biological status assessments and recovery objectives. The plan also incorporates the work of the Willamette/Lower Columbia Technical Recovery Team (TRT), which was convened by NOAA Fisheries to make recommendations on biological criteria for population and ESU-level viability. These criteria set forth the conditions needed to achieve a high probability of persistence into the future.

## Naturally-produced Fish Spawning Naturally

Recovery ultimately depends on naturally-produced fish spawning naturally. Populations maintained through a continuing influx of hatchery fish are not sustainable if they are likely to become extinct whenever the hatchery subsidy is removed. Hatcheries potentially represent a critical tool for preservation, reintroduction, and supplementation over the short term. In fact remnants of many lower Columbia River salmon populations currently exist only in hatcheries. However, no hatchery has demonstrated the capability of preserving the historical natural diversity and behavior necessary to preserve a species over many generations. This plan recognizes that current conditions and constraints on habitat restoration in some areas will require recovery using a combination of natural only and natural/hatchery populations. Hatcheries will continue to serve

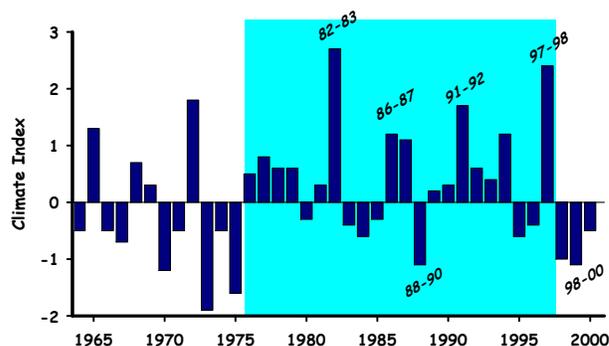
both production and fisheries enhancement purposes for the foreseeable future.

## In-basin and Out-of-basin Influences

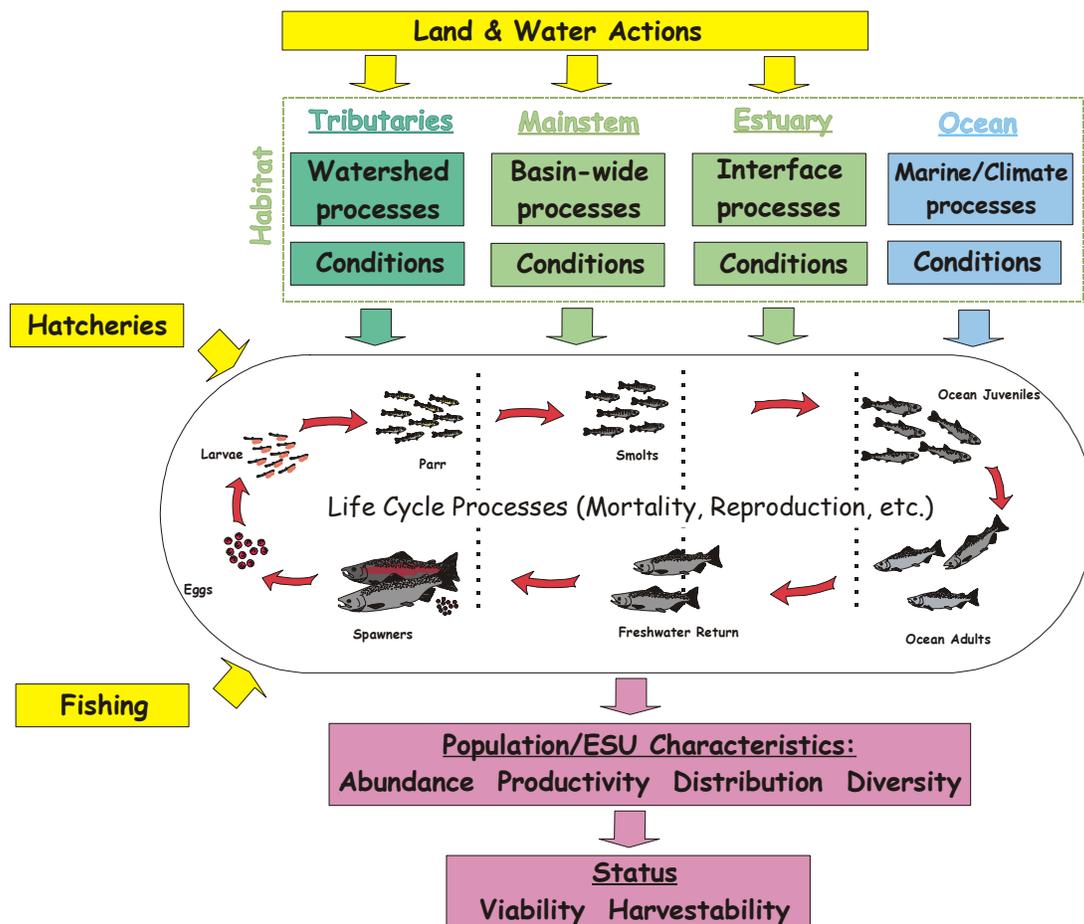
Effective recovery planning must consider in-basin and out-of-basin influences that affect salmon throughout their life cycle. A fish life cycle focus provides a systematic means of relating fish-specific recovery goals to limiting factors, threats, and recovery measures. A life cycle focus identifies life stage-specific numbers, birth rates, and death rates that account for the biological processes regulating fish population health. Life stage-specific population numbers and productivity (growth) rates provide a consistent way to estimate effects of each threat category. A life cycle approach incorporates all biological characteristics related to viability and also provides a means of considering wild and hatchery fish separately.

## Ocean and Climate Variability

Recovery actions must be considered in light of the significant effects that variation in ocean conditions has on salmon survival. Periodic poor ocean cycles can significantly increase the extinction risk for a population compromised by human impacts. Recent large salmon runs suggest that we may have entered at least a short period of better-than-average ocean survival conditions. Rather than reducing the need for salmon recovery, this pattern provides an opportunity to implement substantive recovery actions needed to help a population withstand the next cycle of poor ocean conditions.



Ocean Conditions over Time



### Linking Actions to Limiting Factors & Threats

Recovery actions need to be linked to the limiting factors and threats that affect each species. Factors and threats include a wide spectrum of human-induced mortality factors that affect fish throughout their life cycles. The plan weighs all the human-induced effects on mortality at the various life stages, identifies how mortality can be reduced overall, and determines how the distribution of mortality may be changed among life stages to achieve biological recovery and other social goals.

### Science: Guidance with limitations

Expectations of recovery planning must be tempered by our imperfect understanding of the complex interaction of fish, limiting factors, and human activities. This plan recommends actions from fish managers, agency administrators, tribal leaders, elected officials, and the public based on the best available science. This scientific base

provides a clear direction but does not resolve every uncertainty. However, to delay all action until more studies and research can be completed risks further deterioration of the species and ecosystems upon which they depend.

### Dealing with Uncertainty

Incomplete human understanding of biological systems, and of the effects of human activities and management practices on those systems, results in uncertainty about the outcomes of the actions identified in the plan. The plan recognizes and accommodates uncertainty by explicitly identifying assumptions and working hypotheses, incorporating safety factors into recovery scenarios and population objectives, and identifying a strong monitoring, research, and evaluation program that provides the means for adjusting recovery actions when necessary.



Population persistence categories identified by the Technical Recovery Team

Scale	Viability	Description	Persistence probability <sup>1</sup>
0	Very low	Either extinct or very high risk of extinction	0-40%
1	Low	Relatively high risk of extinction	40-74%
2	Medium	Medium risk of extinction	75-94%
3	High	Low (negligible) risk of extinction	95-99%
4	Very High	Very low risk of extinction	>99%

<sup>1</sup>100-years.

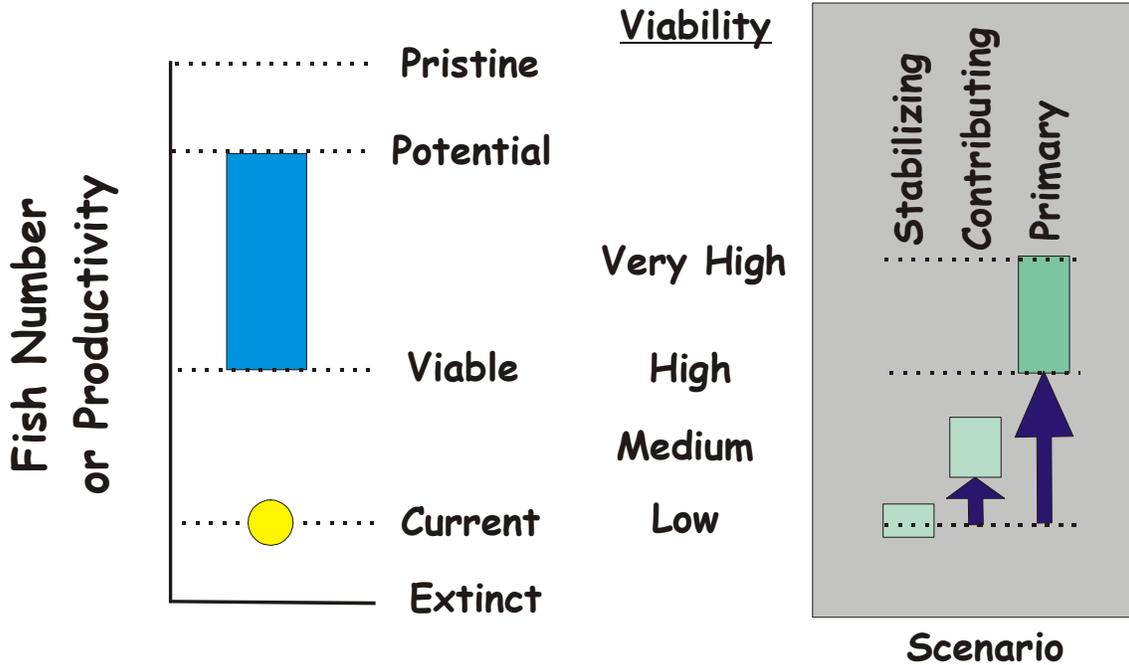
The scenario in this plan is consistent with the TRT's guidelines. It will achieve at least a medium average viability for each stratum (see above table). At least two Washington populations are targeted for improvement to high or very high levels of viability in every strata except for the Gorge. Recovery prospect in the Gorge are highly uncertain because of constraints imposed by Bonneville Dam. More than the minimum numbers of populations and improvement increments consistent with viability have been incorporated into the scenario to compensate for recovery uncertainties in the Gorge and to provide safety

factors should not all attempts prove successful.

A key implication of the TRT's recommendations is that not every population needs to be restored to high levels to recover an ESU. The criteria allow efforts to be concentrated in subbasins where multiple species benefits and moderate to high quality habitat provide good prospects for cost effective results. Substantial improvements are not required in some severely degraded subbasins, although criteria require additional protection and restoration efforts to prevent further declines.

		Fall Chinook (tule)	Fall Chinook (bright)	Spring Chinook	Chum	Winter steelhead	Summer steelhead	Coho
<b>COAST</b>	Grays/Chinook	P	--	--	P*	P	--	P
	Elochoman/Skamokawa	P	--	--	P	C	--	P
	Mill/Abernathy/Germany	C	--	--	P	P	--	C
	Youngs Bay (OR)	S	--	--	P	na	--	S
	Big Creek (OR)	S	--	--	C	na	--	P
	Clatskanie (OR)	P	--	--	C	na	--	S
	Scappoose (OR)	S	--	--	C	na	--	P
<b>CASCADE</b>	Lower Cowlitz	C	--	--	C	C	--	P
	Upper Cowlitz	S	--	P*	--	C	--	C
	Cispus	--	--	P*	--	C	--	C
	Tilton	--	--	S	--	C	--	C
	SF Toutle	X	--	C	X	P*	--	P
	NF Toutle	S	--	X	X	P	--	P
	Coweeman	P*	--	--	X	P	--	P
	Kalama	P	--	P	C	P*	P	C
	Lewis (NF)	X	P*	P	X	C	S	C
	EF Lewis	P*	--	--	P	P	P	P
	Salmon	X	--	--	S	S	--	S
	Washougal	P	--	--	P*	C	P*	C
	Sandy (OR)	S	P	P	P	P	--	P*
	Clackamas (OR)	C	--	--	C	P	--	P*
<b>GORGE</b>	Lower Gorge	C	--	--	P*	P	--	P
	Upper Gorge	S	--	--	C	S	P*	P
	White Salmon	C	--	C	--	--	--	C
	Hood (OR)	S	--	P	--	P	P	C

P: Primary, C: Contributing, S: stabilizing, X: subset of larger population, \*: high+ viability, '--': not present.



**Salmon and Steelhead Population Objectives**

**Abundance.**– Population recovery objectives describe the numbers of fish necessary to reach stabilizing, contributing, or primary population levels. This plan identifies specific numerical objectives consistent with TRT criteria for population abundance based on population and habitat modeling.

**Productivity.**– Productivity is defined as the inherent population replacement rate and is typically expressed as a median rate of population increase or a spawner recruit per spawner replacement rate. Productivity or population growth rate objectives are described in terms of relative improvement increments.

Improvement increments identify the order of magnitude of improvements needed in each population to reach recovery goals. The magnitude of improvements provides the basis for the design of recovery strategies, measures, and actions.

Analyses highlight the need for substantial improvements in productivity for almost all populations in order to reach recovery goals. Net

improvement increments for fall Chinook ranged from 0% for stabilizing populations to 200% for at least one population targeted for very high viability. Net productivity improvements for fall Chinook populations targeted for high viability averaged 30%. Improvement increments were not defined for spring Chinook because access has been eliminated to all historical habitat or because data were inadequate to quantify current populations trends. Net productivity increments to reach high viability were 30-1000% for chum and 10-80% for steelhead. Data were insufficient for comparable estimates for coho but it can be assumed that improvement increments are similar to or greater than those of steelhead.

**Human Impacts and Threats.** – This plan also identifies objectives for reducing human impacts and threats that constrain population viability. These incremental improvements are identified as starting points to indicate the general level of effort that will be required from each sector to achieve recovery. Impact reduction objectives describe changes in potentially manageable factors consistent with abundance and productivity objectives. Changes are referenced to a baseline period corresponding to species listing dates.

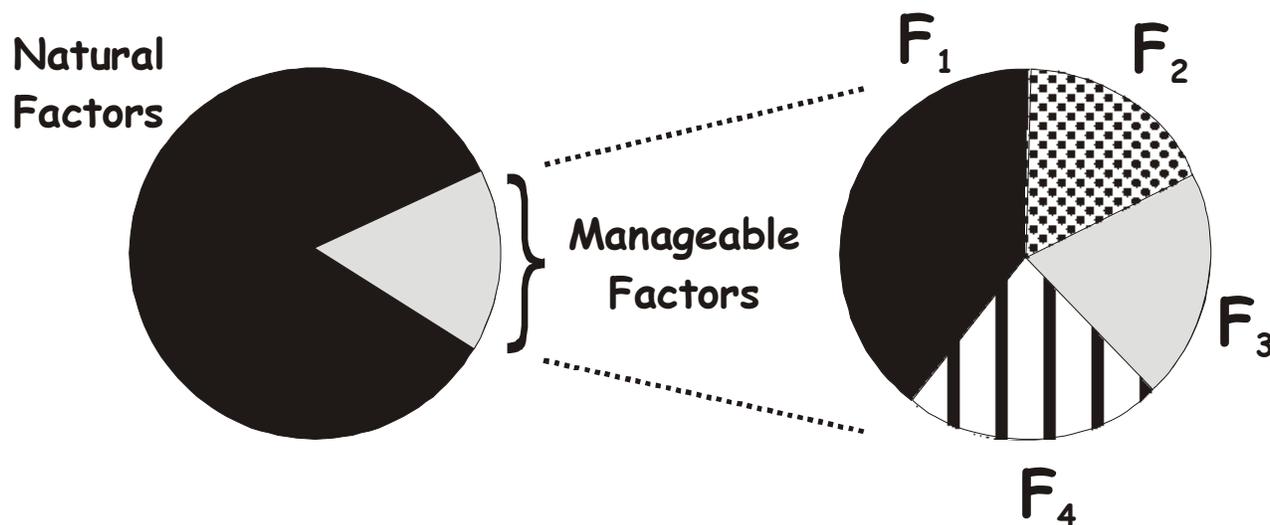
Impacts are estimates of the proportional reduction in population productivity associated with human-caused and other potentially manageable impacts including stream habitats, estuary/mainstem habitats, hydropower, harvest, hatcheries, and selected predators. Incremental improvements needed in each impact factor were estimated from the net productivity improvement needed to reach the population goal, the net effect of human and other potentially manageable impacts, and the distribution of impacts among the factors.

Impact estimates are based on a simple salmon life cycle modeling approach (Adult Equivalent Impacts Occurring Unconditionally or ‘AEIOU’) developed by the LCFRB for this plan. This approach has also been used in this plan to illustrate the relative significance of each factor with a series of pie diagrams.

Recovery strategies, measures, and actions detailed elsewhere in this plan address both quantifiable and unquantifiable threats. Specific threat criteria are not explicitly identified in this plan but the plan does incorporate substantive strategies and measures to reduce threats in every category.

**Other Population Parameters.** – The WLC-TRT developed guidelines based on population parameters including abundance, productivity, spatial structure, diversity, juvenile numbers, and habitat. This plan addresses all TRT parameters for ESU and strata. It identifies specific quantitative abundance and productivity objectives for each listed population. Specific population objectives were not identified for VSP parameters other than abundance and productivity because many different combinations of specific parameters can be expected to achieve the overarching population objectives. Benchmark values are identified for other VSP parameters to provide a systematic basis for their consideration during plan implementation and evaluation. All VSP parameters will be evaluated in future assessments of population status using the TRT’s scoring system.

**Harvestable Populations.** – Initial efforts to stabilize and rebuild natural populations warrant fishery limitations with rates consistent with restoration of salmon and steelhead populations. As natural productivity is restored, it is anticipated that more fishery opportunities will be restored at sustainable levels. This plan includes long-term objectives for harvestable natural populations.



## Bull Trout Objectives

Bull trout are subject of a draft recovery plan, although the USFWS recently decided to delay finishing the recovery plan in lieu of a 5-year review of the bull trout listing. Of the subbasins addressed by this plan, bull trout currently occur only in the upper Lewis River and possibly the White Salmon River.

This plan integrates regional goals and objectives identified in the draft Bull Trout Recovery Plan into subbasin-specific actions.

The overarching goal of the draft bull trout recovery plan is to ensure the long-term persistence of self-sustaining, complex interacting groups (or multiple local populations that may have overlapping spawning and rearing areas) of bull trout distributed across the species' native range. Specific objectives include:

1. Maintain current distribution within core areas and restore distribution in additional areas,
2. Maintain stable or increasing trends in abundance,
3. Restore and maintain suitable habitat conditions for all life history stages and strategies, and
4. Conserve genetic diversity and provide opportunity for genetic exchange.



**Spawning Bull Trout**

## Other Sensitive Species

Objectives for other fish and wildlife species are generally based on other management plans and processes, and are included here for information purposes relative to the primary focus of this plan on salmonids.

**Bald Eagle** – Increase the viability of the bald eagle breeding population in the lower Columbia River, particularly through increased reproductive success.

**Sandhill Crane** – Support and maintain the wintering population of sandhill cranes in the lower Columbia River, while limiting crop depredation.

**Dusky Canada Goose** – Reverse the declining abundance trend and maintain a wintering population in the lower Columbia River, while limiting crop depredation.

**Columbian White-tailed Deer** – Increase productivity and abundance, thereby creating a stable, viable population.

**Fisher** – Minimize risks to populations in the process of becoming established while increasing quantity and quality of habitat and minimizing incidental mortality.

**Western Gray Squirrel** – Increase quantity and quality of habitat and reduce effects of nonnative species.

**Seals and Sea Lions** – Maintain current seasonal population abundance while limiting predation risks to adult salmonids.

**Western Pond Turtle** – Reverse the declining abundance trend in Washington and to re-establish in the Puget Sound and Columbia Gorge regions at least 5 self-sustaining populations of greater than 200 turtles composed of no more than 70% adults.

**Oregon Spotted Frog** – Increase quantity and quality of habitat and reduce effects of nonnative species.

**Larch Mountain Salamander** – Increase quantity and quality of habitat and minimize use of key habitats.



**Eulachon (smelt)**

### Species of Ecological Significance

**Coastal Cutthroat Trout** – Reverse declining abundance trends and maintain life history diversity (resident, fluvial, and anadromous forms).

**White Sturgeon** – Continue management for a viable population that will maintain sufficient abundance to meet the continued cultural, economic, and ecological needs.

**Green Sturgeon** – Continue management for a viable population that will maintain sufficient abundance to meet the continued cultural, economic, and ecological needs.

**Eulachon (Smelt)** – Maintain or increase annual population abundance to continue to provide forage value for other species and harvest opportunities for commercial and recreational fisheries.

**Pacific Lamprey** – Reverse the decreasing abundance trend and manage for populations that can meet cultural and ecological needs.

**Northern Pikeminnow** – Decrease predation on juvenile salmonids by reducing the number of larger, predaceous pikeminnow in the population, while also maintaining pikeminnow population viability.

**American Shad** – Decrease abundance but maintain a viable population (range from 0.7 to 1.0 million, well below the recent record run sizes) while avoiding adverse impacts on other species, particularly the recovery of salmon and steelhead.

**Band-tailed Pigeon** – Increase quantity and quality of habitat.

**Caspian Tern** – Maintain population viability region-wide and decrease the population's vulnerability to catastrophic events while also managing predation on salmon.

**Osprey** – Increase the viability of the osprey breeding population in the lower Columbia River, particularly through increased reproductive success.

**Yellow Warbler** – Protect critical preferred habitat including riparian zones characterized by a dense deciduous shrub layer (1.5-4 m) with edge and small patch size (heterogeneity).

**Red-eyed Vireo** – Protect critical preferred habitat including riparian gallery forest with tall, closed canopy forests of deciduous trees (cottonwood, maple, or alder and ash), with a deciduous understory, forest stand sizes larger than 50 acres, and riparian corridor widths greater than 50 m.

**River Otter** – Maintain current population abundance.

### Species of Recreational Significance

**Walleye** – Adaptively manage the population to maintain or reduce current abundance levels while minimizing adverse impacts on salmon, steelhead, and other native fishes.

**Smallmouth Bass** – Adaptively manage the population to maintain or reduce current abundance levels while minimizing adverse impacts on salmon, steelhead, and other native fishes.

**Channel Catfish** – Adaptively manage the population to limit adverse impacts on salmon, steelhead, and other native fishes.



**American Shad**

## REGIONAL STRATEGIES & MEASURES

The regional recovery strategies involve substantive reductions in every threat category (stream habitats, estuary and mainstem habitats, hydropower, harvest, hatcheries, and ecological interactions). Strategies are based on underlying working hypotheses that describe assumptions, conclusions, or testable hypotheses. Explanations are included for each element to clarify the scientific basis, strength of rationale, and relationship to current practice.

Measures are more specific means by which strategies will be accomplished. The plan initially assumes that recovery will require substantive measures to address every significant threat due to uncertainty in the degree of benefit that will accrue from any given measure.

An even finer definition of recovery requirements is represented by actions that are described in the implementation chapter and subbasin volumes of the plan. Strategies, measures, and actions describe increasingly-specific activities for achieving recovery. Measures are generally described at the level of the desired physical or biological effects (e.g. protect and restore riparian habitat). Actions are generally described at the implementing organization and program level, and are related back to the desired biological or physical effect (e.g. Washington Department of Natural Resources will implement forest practices rules on private timber lands to protect riparian areas). Specific measures might address several strategies and specific actions might address several measures.

Strategies, measures, and actions included in the plan were identified based on species, and subbasin recovery goals. Additional measures and actions may affect fish but until additional information demonstrates otherwise, all measures and actions identified in the plan are assumed to be necessary to achieve recovery objectives. Priorities will evolve over time

based on new information, progress in implementation, and adaptive management.

### Integrated Regional Strategy

*Working hypotheses* emphasize that:

- ❑ It is feasible to recover Washington lower Columbia natural salmon and steelhead to healthy and harvestable levels.
- ❑ Substantial improvements in salmon and steelhead numbers, productivity, distribution, and diversity will be required.
- ❑ Recovery cannot be achieved based solely on improvements for any one limiting factor or threat.
- ❑ Existing programs are insufficient to reach recovery goals.
- ❑ Actions needed for salmon recovery will have broader ecosystem benefits for all fish and wildlife species of interest.
- ❑ Strategies and measures likely to contribute to recovery can be identified but estimates of the incremental improvements resulting from each specific action are uncertain.

*Integrated Strategies* include:

- ❑ Recognize the importance of implementing strategies and measures that address each limiting factor and threat category.
- ❑ Prescribe improvements in each factor/threat category in proportion to its magnitude of contribution to salmon declines.
- ❑ Identify an appropriate balance of strategies and measures that address regional, upstream, and downstream threats.
- ❑ Scale a suite of factor-specific recovery strategies and measures to meet biological objectives while also recognizing large uncertainty in the incremental contributions of individual actions.
- ❑ Focus near term actions on species at risk of extinction while also ensuring a long term balance with other species and the ecosystem.

## Stream Habitats

Habitat strategies, measures, and actions were based on an extensive review of the available habitat information and analyses as well as new analysis of stream conditions, watershed conditions, and habitat forming processes. Modeling tools were applied to identify reach scale issues that need to be addressed and provide a prioritization scheme that is linked to the input data and to expectations of the actions proposed.

**Working hypotheses** include, but are not limited to such considerations as:

- ❑ Healthy, harvestable salmon populations depend on favorable stream habitats for migration, spawning, and rearing.
- ❑ Current stream habitat is much less favorable than necessary to support healthy natural salmon and steelhead populations.
- ❑ Substantial changes are needed to support recovery.
- ❑ Recovery can be achieved without restoration of pristine conditions and without restoration of optimum habitat in every subbasin.
- ❑ Some level of increased habitat protection and restoration will be required in every subbasin to arrest declining trends and restore populations.

**Strategies** include:

- ❑ Restoration of harvestable salmon and steelhead through better habitat access, protection, and restoration.
- ❑ Strong protection of habitats that currently support significant fish production for priority fish populations.
- ❑ Address both instream habitat conditions that limit fish and watershed stream habitat-forming processes that shape, create, or maintain habitat in any given location.

Numerous **measures** for protecting and restoring stream habitats are listed in the Management Plan under the broad topics of:

- ❑ Critical preservation areas
- ❑ Habitat protection & land-use planning
- ❑ Instream flows
- ❑ Habitat connectivity
- ❑ Forest land management
- ❑ Channel restoration
- ❑ Riparian and floodplain restoration
- ❑ Watershed process restoration
- ❑ Wetlands restoration
- ❑ Recreation management.

Habitat measures are relatively specific. For example, recommendations under the topic of land-use planning include:

- ❑ Discourage land-use conversion to more detrimental uses (e.g. forestry to crop land, crop land to residential).
- ❑ Establish urban growth boundaries based on resource protection criteria.
- ❑ Prevent increased watershed imperviousness.

## Estuary and Lower River Habitat

The estuary and lower Columbia river play a critical role in the life cycles of all Columbia Basin salmon and steelhead. This plan addresses both historic and current factors limiting salmon and steelhead. Actions are linked to threats at a general level consistent with our current knowledge and analytical tools. Hypotheses, strategies, and measures are consistent with the Bi-State Estuary/Lower Mainstem Subbasin Plan and to the Lower Columbia River Estuary Partnership Comprehensive Conservation and Management Plan.

Some of the **working hypotheses** for estuary and lower river habitat include concepts such as:

- ❑ Complex and dynamic interactions between physical river and oceanographic processes, along with climate and human activities, affect fish and wildlife habitat in the estuary and lower mainstem.

- Human activities have altered how the natural processes interact, changing estuary and lower mainstem habitat conditions.
- Current understanding of interrelationships among fish, wildlife, and limiting habitat conditions in the estuary and lower mainstem is not robust and introduces substantial uncertainty in recovery and sustainability of natural resources.

To address these and other issues, planners have identified eight broad *strategies* for the lower river and estuary such as:

- Avoiding large scale habitat changes where risks to salmon and steelhead are uncertain.
- Protecting functioning habitats while also restoring impaired habitats to properly functioning conditions.
- Striving to understand, protect, and restore habitat-forming processes in the estuary and lower mainstem.

Recommended *measures* include:

- Restoring tidal swamp and marsh habitat in the estuary and tidal freshwaters.
- Restoring connectedness between river and floodplain.
- Limiting the effects of toxic contaminants on salmon and steelhead and wildlife fitness and survival in the estuary, lower mainstem, and nearshore ocean.
- Mitigating channel dredge activities in the estuary and lower mainstem.
- Improving knowledge of the interrelationships among fish, wildlife, and limiting habitat conditions in the estuary and lower mainstem.

## Hydropower

Near-term and long-term strategies and measures are identified to ensure that hydroelectric facilities and operations in subbasins and the mainstem Columbia River support recovery of naturally-spawning lower Columbia River fish.

Examples of *working hypotheses* include:

- Tributary hydropower development and operation has blocked access to large areas of historically productive habitat in some subbasins and affected habitat conditions and suitability downstream.
- Bonneville Dam affects migration and passage of juvenile and adult salmon and inhibits recovery.
- Construction and operation of the Columbia River hydropower system has contributed to changes in estuary and lower mainstem habitat and habitat forming processes that inhibits salmon and steelhead population resilience and recovery.

Corresponding *strategies* include:

- Restoring access of key populations to blocked habitats in historically accessible portions of subbasins.
- Assuring that the Columbia River hydropower system is managed to contribute to recovery of lower river as well as upstream populations.

Specific *measures* identified to reduce the effects of hydropower operations on salmon and steelhead recovery include:

- Implement anadromous fish reintroduction upstream of Cowlitz and Lewis hydroelectric projects as part of relicensing processes or requirements. Improve and operate effective juvenile and adult passage facilities at Bonneville Dam.
- Maintain adequate flows in Bonneville Dam tailrace and downstream habitats during salmon incubation and migration periods.
- Establish an annual Columbia River water budget that simulates peak seasonal discharge, increases flow variability during salmonid emigrations, and restores estuarine tidal channel complexity.

## Harvest

Strategies, measures, and actions focus on two areas. The first is to limit harvest impacts on recovery efforts and to ultimately restore naturally-spawning fish populations to harvestable levels. The second is to preserve fishery opportunities focusing on hatchery fish and strong wild stocks in a manner that does not adversely affect recovery efforts. Measures are included to integrate consideration of recovery goals into Pacific Salmon Treaty, Pacific Fishery Management Council, and US v. Oregon processes and to improve marking programs and monitoring of fishery catch.

*Working hypotheses* help to set the stage for identifying strategies and measures. Examples include:

- ❑ Historic fishing rates, in conjunction with other factors, posed significant risks to the continued existence of many naturally spawning populations and were not sustainable.
- ❑ Recent changes in fishery management have substantially reduced harvest risks to naturally spawning populations.
- ❑ Additional fishery management opportunities exist for reducing population risks for some species, such as fall Chinook, but are limited for others, such as chum and steelhead.

Corresponding *strategies* include:

- ❑ Assure fishery impacts to lower Columbia naturally spawning populations are managed to contribute to recovery.
- ❑ Preserve fishery opportunity focused on hatchery fish and strong naturally spawning stocks in a manner that does not adversely affect recovery.

Harvest *measures* include:

- ❑ Fishery Management and Evaluation Plans for lower Columbia ESUs will be revised as needed to support recovery goals and priorities.
- ❑ Research and employ best available technology to reduce incidental mortality of

non-target naturally-spawning fish in selective fisheries.

- ❑ Conduct periodic review of harvest and escapement relative to habitat productivity and capacity to assure harvest is properly managed for recovery.
- ❑ Improve tools to monitor and evaluate fishery catch to assure impacts to natural populations are maintained within agreed limits.

## Hatcheries

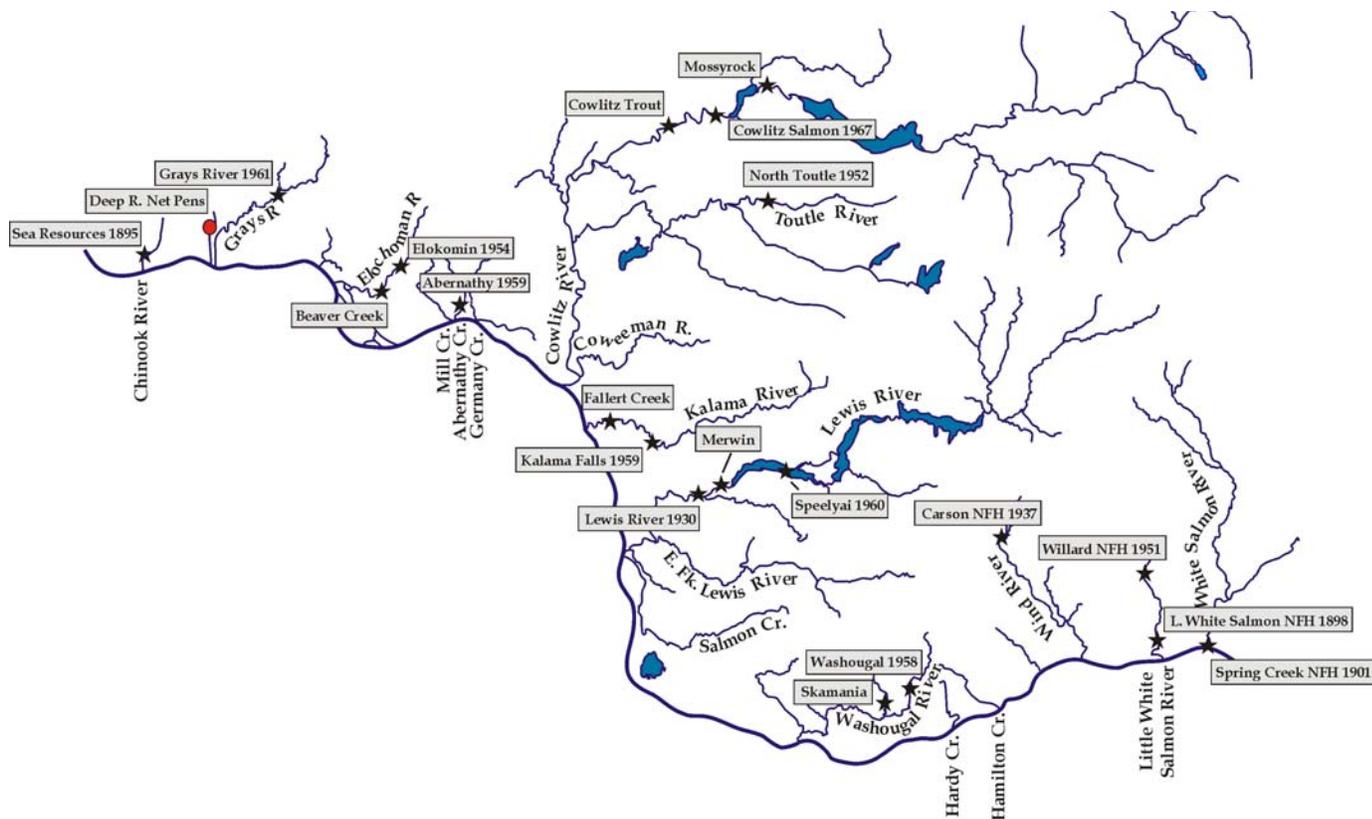
The hatchery strategy describes near-term and long-term strategies and measures to ensure that hatcheries support recovery of naturally-spawning fish. Some subbasins will be free of hatchery influence and hatchery programs. In other subbasins hatchery programs will serve specific conservation and harvest purposes consistent with goals for naturally-spawning populations. This mosaic of programs is designed to ensure that overall each ESU will be naturally self-sustaining.

Nine *working hypotheses* were developed that address the effects of hatcheries on natural salmonid populations. For example:

- ❑ Additional reductions in hatchery impacts are needed for recovery of natural populations.
- ❑ Changes in hatchery operations have and will continue to contribute to reduced risks to naturally spawning populations.
- ❑ Conservation hatchery programs can contribute to recovery through the preservation, reintroduction, and supplementation of natural populations.
- ❑ Hatcheries can provide harvest opportunities consistent with measures to maintain healthy harvestable naturally spawning populations.

Hatchery *strategies* include:

- ❑ Expanding hatchery reintroduction and supplementation to help recover natural populations when and where appropriate.



**Major Lower Columbia region salmon and trout hatchery facilities**

- Reconfiguring production-based hatchery programs to minimize impacts on natural populations and complement recovery objectives.

Hatchery *measures* include:

- Promote region-wide recovery by using hatcheries as tools for supplementation and reintroduction in appropriate watersheds.
- Operate hatcheries with appropriate risk containment measures for: 1) hatchery-origin adults returning to natural spawning areas, 2) release of hatchery juveniles, 3) handling of natural-origin adults at hatchery facilities, 4) water quality and effective disease control, and 5) mixed stock fisheries.
- Mark hatchery-produced fish to assure they are identifiable for harvest management and escapement accounting.
- Adaptively manage hatcheries to respond to future knowledge, enhance natural production, and improve operational efficiencies.

- Use appropriate broodstock in hatchery programs.

### Ecological Interactions

Ecological interactions refer to the relationships of salmon and steelhead with other elements of the ecosystem. Strategies and measures are identified to address non-native species, effects of salmon on ecosystem productivity, and native predators of salmon.

Ecological interaction *working hypotheses* recognize that:

- Non-native, invasive, and exotic species often reduce or displace native species, particularly in human-altered habitats.
- Salmon are but one element in a complex ecosystem, have been a significant source of nutrients in freshwater systems, and are both predator and prey.

- Human-induced habitat changes have substantially exacerbated predation in the lower Columbia River mainstem and estuary.

Three region-wide *strategies* have been identified to address ecological interactions:

- Aggressive measures should be taken to avoid introductions of new species and to reduce the potential adverse effects of existing non-native species.
- The significance of salmon to the productivity of other species and the salmon themselves should be recognized.
- Manage predation by selected species while also maintaining a balance of predator populations.

Ten specific *measures* for ecological interactions have been developed. Several of these are:

- Implement regulatory, control, and education measures to prevent additional invasions.
- Take proactive steps to control or reduce the impacts of introduced, invasive, or exotic species.
- Manage established populations of introduced gamefish to limit or reduce significant predation or competition risks to salmon, and to optimize fishery benefits within these constraints.
- Consider ecological functions of salmon, including nutrients they deliver to watersheds, in setting escapement goals.

## Other Fish and Wildlife Species

Many of the fish and wildlife species addressed in this plan are currently experiencing stable or increasing population trends; despite their current status, implementing an ecosystem-based approach to the recovery of ESA-listed species warrants evaluation of the effects of recovery actions on other fish and wildlife species. The strategies and measures suggested within this management plan have been formulated to minimize conflict among species-specific strategies and measures.

Other fish and wildlife species addressed in this plan are limited by many of the same factors as those identified for salmonids. Thus, it follows that many of the hypotheses, strategies, and measures developed for salmonids also apply to the other fish and wildlife species. In particular, regional strategies and measures for subbasin habitat, estuary and mainstem habitat, hydropower operation, and ecological interactions are most pertinent to the other fish and wildlife species.

## MONITORING & RESEARCH

The plan identifies specific monitoring and research measures as well as working hypotheses, strategies, and explanations underlying those measures. Monitoring and evaluation will be integral to the successful implementation of this plan in the face of significant scientific uncertainty regarding the precise benefits that will result from any specific action.

Monitoring and research elements of this plan were adapted from and are consistent with other regional strategies and plans developed by the NPCC Independent Scientific Advisory Board, Washington Salmon Recovery Funding Board, Federal Columbia River Power System Biological Opinion, Upper Columbia Regional Technical Team, and Pacific Northwest Aquatic Monitoring Partnership.

### Monitoring

Monitoring measures involve regular sampling and measurement of representative biological, physical, or programmatic parameters. Monitoring includes a mixture of activities of varying intensity, ranging from routine monitoring that involves repeated measurements of representative indices at regular intervals to statistical monitoring intended to provide inferences to larger areas and longer time periods. Monitoring measures include a mix of ongoing and new activities.

### Research

Critical uncertainty research is focused on cause and effect relationships between fish, limiting factors/threats, and actions that address specific factors/threats. These critical uncertainties constrain our ability to identify or evaluate the effects of specific actions. The plan identifies a series of critical research questions for each threat category.

### Types of Monitoring

*Biological status monitoring* focuses on population parameters including distribution, abundance, productivity, diversity to describe progress toward recovery objectives.

*Habitat status monitoring* focuses on trends in conditions in response to the cumulative effects of human activities and recovery measures and also establishes a baseline for evaluating causal relationships between limiting factors and a population response.

*Action effectiveness monitoring* determines if specific habitat, hydropower, hatchery, harvest, and ecological interaction measures produce the specific intended effect.

*Implementation and compliance monitoring* determines whether actions were implemented as planned or meet established laws, rules, and benchmarks.

### Data Coordination and Management

Coordination and data management measures are included to ensure efficient implementation of a comprehensive and complementary program as well as accessibility and effective application of the associated data. An approach will be based on a detailed management needs assessment and data management plan.

**PLAN IMPLEMENTATION**

This plan provides a blueprint for salmon and steelhead recovery that includes specific strategies, measures, and actions needed to:

- ❑ Address all threats.
- ❑
- ❑ Reverse long term declining trends and establish a trajectory toward recovery.
- ❑ Obtain sufficient information to measure progress.
- ❑ Make course corrections as necessary.

**Implementation Mechanism**

The pervasive scale of human activities that limit or threaten salmonids means that recovery will require a dedicated long-term collective social commitment to preserve and restore salmon and steelhead. The plan identifies the partners with the authority, jurisdiction, or resources needed to implement each action.

The plan does not obligate any party but does establish specific responsibilities for taking actions that have been identified as important to fish recovery. Obligation will come through the commitment of each implementing partner to undertake and complete their actions in a timely, sound, and thorough manner.

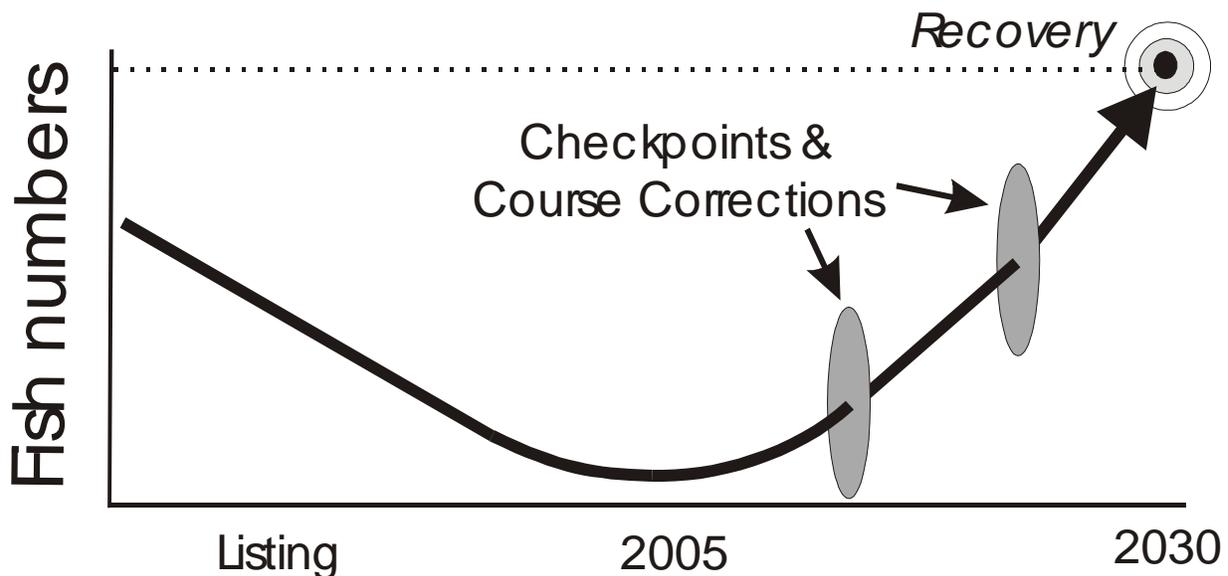
**Institutional Structure**

The institutional structure for plan implementation involves oversight, implementation, and facilitation/coordination responsibilities.

Key oversight bodies include NOAA Fisheries, U.S. Fish and Wildlife Service, tribal governments, the Washington Department of Fish and Wildlife, the Washington Governor’s Office, and the Northwest Power and Conservation Council.

Implementation responsibilities will involve programs and projects by numerous Federal, State, local, and nongovernmental bodies. These entities are referred to as implementation sponsors.

The Lower Columbia Fish Recovery Board working with a steering committee will facilitate and coordinate efforts among oversight and implementing partners. The steering committee will include representatives of oversight bodies and a cross section of implementing partners. Facilitation/coordination will involve setting priorities, evaluating progress, tracking implementation, inventorying and synthesizing monitoring results, developing implementation partnerships and agreements, and revising the plan.



**Implementation Schedules**

The plan implementation process will involve preparation of a series of 6-year action schedules identifying tasks, schedules, priorities, costs, constraints, and responsibilities. Federal, state, tribal, local, and non-governmental partners will be requested to prepare an implementation schedule for their recovery actions. The individual action schedules will be used to develop a coordinated regional 6-year action schedule.

**Economic & Cost Considerations**

Strategies, measures and actions in this plan have been designed and selected based on their anticipated contribution to recovery goals. They are heavily based on biological and technical factors, although consideration was also given social, cultural, and general economic factors. Additional consideration of cost and economic factors will play an important function in developing specific implementation mechanisms and actions that are both scientifically sound and politically and fiscally feasible.

To establish an estimate of implementation costs, implementing partners are requested to provide an estimate of the incremental costs of recovery that will be incurred in addition to costs

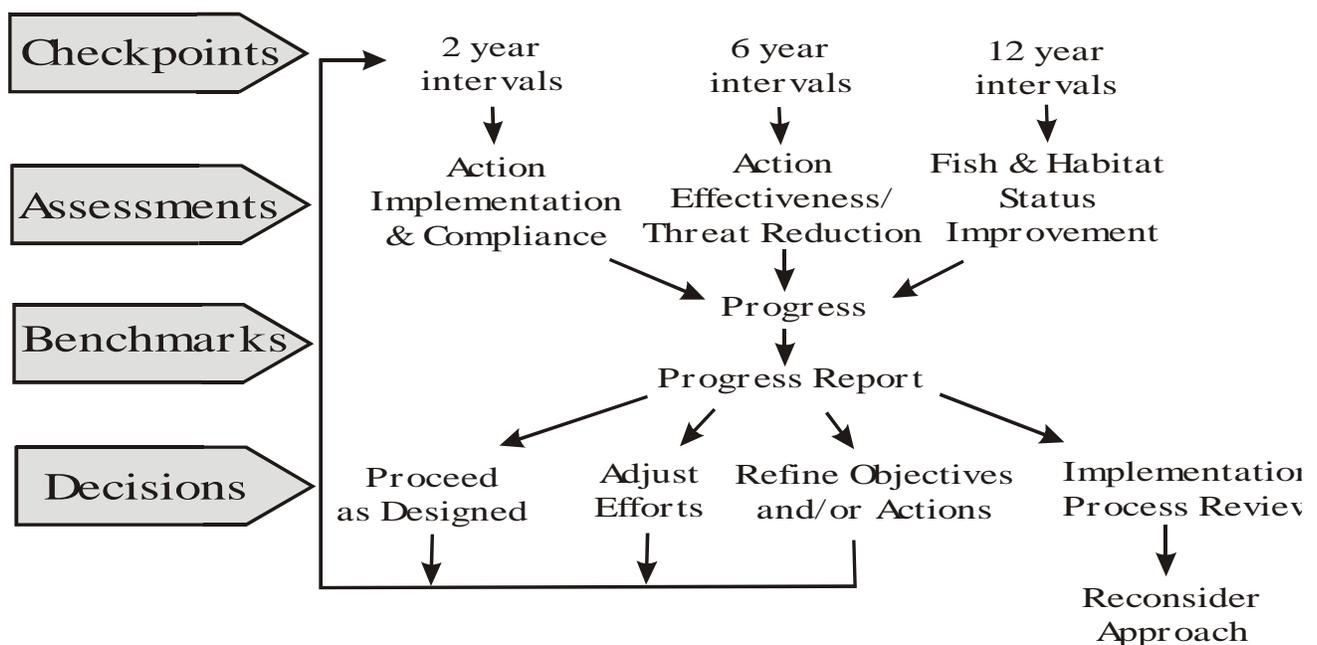
to their existing programs and activities. Partners are also requested to indicate how they will fund these costs and to identify fiscal constraints that would affect timely or full implementation of their actions. This information will be used along with biological, technical, social, and cultural considerations to help refine implementation priorities and to develop a regional funding strategy.

**Adaptive Management**

An adaptive management process and schedule is described that includes checkpoints, assessments, benchmarks, and decisions. *Checkpoints* are formal decision points where the need for changes in direction will be considered. *Assessments* are formal evaluations of progress and results. *Benchmarks* are standards or criteria that will drive decisions depending on observed progress in implementation efforts and effectiveness based on the 6-year implementation schedules prepared by the implementing partners.

*Decisions* identify refinements in efforts or new directions based on progress relative to benchmarks observed at checkpoints.

Adaptive Management Process



Decisions will be based on:

- Whether recovery strategies and measures have been implemented as planned.
- Whether specific strategies and measures significantly have reduced the corresponding threats.
- Whether fish and habitat conditions improved as a result of recovery actions.

### **Public Education & Outreach**

Education refers to the development or promotion of general knowledge or training. Outreach refers to directed educational and involvement efforts directed toward specific constituencies and intended to focus on specific problems or actions.

It is a goal of public education and outreach to engage the public as an active partner in implementing and sustaining recovery efforts. A regional education and outreach program will be established to support, assist and coordinate with similar education and outreach efforts by individual implementing partners.

### **Enforcement of the Plan**

This plan is not a regulatory document and is not enforceable. It relies largely on the cooperative efforts and support of federal and state agencies, tribal governments, local governments, businesses, non-profit organizations, and the people of the region.

Enforcement action alone is not a sufficient or effective means to achieve recovery. However, it is expected that agencies with such authority will exercise it as needed to ensure implementation of their recovery responsibilities. This includes enforcement of ESA regulations by NOAA Fisheries and the USFWS.

### **Plan Sufficiency**

Evaluation of the sufficiency of this plan is based on: 1) substantive strategies, measures, an actions that address all current threats to the viability and harvestability of Washington lower Columbia salmon and steelhead populations, 2)

incorporation of effective monitoring, evaluation, and adaptive management measures and actions as well as an institutional framework for plan implementation, and 3) assessments confirming that reductions in threats are of an order of magnitude consistent with recovery.

Threats to viability and harvestability include all categories of human activities that impact fish numbers, adaptive population characteristics, and habitats. This plan has cataloged threats at length and related them to fish limiting factors. Impacts of key factors in each threat category were quantified based on the best available information and were related to improvement increments needed to achieve biological objectives.

Monitoring, evaluation, and adaptive management components of the plan consider whether actions were implemented as designed, actions produce the expected effect, and the net effects of multiple actions produce the desired improvement in fish populations. Quantitative estimates of the impacts of key threat factors and expected responses projected from fish life cycle and habitat models provide testable hypotheses for the monitoring, evaluation, and adaptive management efforts.

The immediate test of plan sufficiency is whether current working hypotheses, strategies, measures, and actions provide a plausible scientific basis for reversing decline fish trends and providing a significant trajectory toward recovery. Existing information and tools are adequate to evaluate whether proposed actions are of an order of magnitude to significantly reduce threats to the level where a response in fish populations can feasibly be measured and a trajectory for recovery can be detected. These assessments will be completed as part of the plan development and implementation process.

### **Plan Interpretation & Revision**

It is likely during the course of implementing the recovery plan that questions will arise that will require interpretation or clarification of the plan goals, objectives, strategies, measures, and

actions. Revisions may also be warranted to address issues or new information that may arise during implementation or to facilitate effective plan implementation. The Implementation Steering Committee shall be responsible for such interpretations, clarifications, or revisions and may consult with federal state or local agencies or the NOAA Fisheries Technical Recovery Team (TRT) as deemed appropriate.

### Monitoring, Research & Evaluation Plan

The LCFRB and the Implementation Steering Committee will direct and coordinate the implementation of the monitoring, research and evaluation provisions set forth in this plan. The program will also define the procedures and benchmarks for implementing the Adaptive Management Process. The LCFRB and Implementation Steering Committee shall convene and work with a Monitoring, Research, and Evaluation Working Group to develop implementation measures and responsibilities. The Working Group will consist of representatives from federal, state, regional, and local programs engaged in biological and habitat status monitoring, effectiveness monitoring, implementation/compliance monitoring and biological and habitat research. The working group will prepare and submit to the Implementation Steering Committee recommendations for a Monitoring, Research, and Evaluation Program.

### Responsibilities and Schedule

All actions identified in this plan were deemed to be significant for recovery, hence can be considered a high priority. Some actions warrant more immediate implementation because of the acute nature of the problem they address and the availability of necessary infrastructure and resources.

Actions are organized by the entity that would be involved in implementation. Because multiple entities are involved in the implementation of certain actions, some actions are listed under more than one entity. In some cases, no single entity has full authority to implement an action,

and successful implementation will depend on the coordination and cooperation of a number of agencies. In other cases, while one entity may have lead authority and implementation responsibility, effective implementation will depend on the involvement, support, and agreement of a number of agencies. In the process of developing implementation schedules, lead entities may be identified for an action involving two or more partners.

## SUBBASINS

A series of Subbasins Plans (Volumes II.A-II.L) describe local conditions and detail implementation of the regional plan at the subbasin level. Each subbasin plan includes:

- An *overview summary* of key priorities.
- An *assessment* that describes the subbasin, species of interest, subbasin habitat conditions, stream habitat limitations, watershed process limitations, other factors such as hatcheries, harvest, hydropower, and out-of-subbasin effects. The assessment includes qualitative and quantitative information.
- A *program and project inventory* describing significant activities in the subbasin. (More detailed program descriptions may also be found in a regional program directory contained in Technical Appendix C.)
- A *management plan* that details a subbasin vision, biological objectives, integrated strategy, and specific measures and actions for each threat category.

The following descriptions summary for each subbasin.

### Lower Columbia Mainstem and Estuary

The lower Columbia River mainstem is a critical migration corridor and rearing area for every population of salmon and steelhead in the Columbia River basin as well as a variety of other fish and wildlife species. Habitats and habitat shaping processes have been substantially altered by local development and changes in river dynamics that have

accompanied extensive hydropower development throughout the system. The estuary subbasin plan is consistent with the joint Oregon and Washington subbasin plan. Priority actions were previously described under regional strategies and measures.

### Estuary Tributaries

The Estuary Subbasin includes a series of small Washington tributaries from the ocean upstream to Deep River. These streams historically supported thousands of fall chinook, chum, and coho. All populations need to be restored to a high level of viability in these tributaries to meet regional recovery objectives. Priority actions include:

- ❑ Restoring passage at tide gates, culverts, and other artificial barriers.
- ❑ Restoring estuary, floodplain, and riparian habitats
- ❑ Managing forests pursuant to Forest and Fish Rules to protect and restore watershed processes,
- ❑ Addressing immediate risks with short term habitat fixes, and
- ❑ Reducing out-of-subbasin impacts.

### Grays Subbasin

This subbasin is particularly important to regional recovery because it is one of two major basins in the coastal strata of the ESU. Populations of fall Chinook, winter steelhead, chum and coho need to be restored to a high level of viability in this subbasin to meet regional recovery objectives. Priority actions include:

- ❑ Reducing out-of-subbasin impacts,
- ❑ Managing forests pursuant to Forest and Fish Rules to restore watershed processes.
- ❑ Restoring valley floodplain function and stream habitat diversity.
- ❑ Aligning hatchery priorities with conservation objectives.

### Elochoman Subbasin

This subbasin includes the Elochoman, Skamokawa, Mill, Abernathy, and Germany watersheds. Populations of fall Chinook, chum, coho and winter steelhead need to be restored to medium and high levels of viability to meet regional recovery objectives. The Elochoman/Skamokawa populations are particularly important for recovery. Priority actions include:

- ❑ Managing forest lands pursuant to Forest and Fish Rules to protect and restore watershed processes,
- ❑ Restoring lowland floodplains, riparian conditions, and stream habitat diversity.
- ❑ Reducing out-of-subbasin impacts,
- ❑ Aligning hatchery priorities with conservation objectives.

### Cowlitz Subbasin

This subbasin is particularly important to regional recovery by virtue of its large size and diverse habitats. It includes lower Cowlitz, upper Cowlitz, Cispus, Tilton, Toutle, and Coweeman watersheds. One or more populations of tule fall Chinook, , spring Chinook, chum, winter steelhead, summer steelhead, and coho are present and many need to be restored to high levels of viability to meet regional recovery objectives. Priority actions include:

- ❑ Restoring access above dams to the upper portion of the basin.
- ❑ Protecting intact forests in headwaters.
- ❑ Managing forest land pursuant to Forest and Fish Rules to protect and restore watershed processes.
- ❑ Managing growth and development to protect watershed processes and habitat conditions.
- ❑ Restoring passage at culverts and other artificial barriers.
- ❑ Restoring lowland floodplain function, riparian conditions, and stream habitat diversity.

- ❑ Addressing immediate risks with short term habitat fixes.
- ❑ Aligning hatchery priorities with conservation objectives.
- ❑ Reducing out-of-subbasin impacts.

### **Kalama Subbasin**

Populations of fall Chinook, spring Chinook, winter steelhead and summer steelhead need to be restored to a high level of viability to meet regional recovery objectives. Coho will need to improve to a medium level of viability and a chum population established and stabilized. Priority actions include:

- ❑ Managing forests pursuant to Forest and Fish Rules to restore watershed processes.
- ❑ Managing growth and development to protect watershed processes and habitat conditions.
- ❑ Restoring passage at culverts and other artificial barriers.
- ❑ Aligning hatchery priorities with conservation objectives.
- ❑ Reducing out-of-subbasin impacts.

### **Lewis Subbasin**

This subbasin is particularly important to regional recovery due to its large size and diverse habitats. It includes the upper North Fork, lower North Fork, and East Fork watersheds. One or more populations of tule fall Chinook, bright fall Chinook, spring Chinook, chum, winter steelhead, summer steelhead, and coho are present and many need to be restored to high levels of viability to meet regional recovery objectives. Priority actions include:

- ❑ Restoring access above dams to the upper portion of the North Fork watershed.
- ❑ Protecting intact forests in headwaters.
- ❑ Managing forest land pursuant to Forest and Fish Rules to protect and restore watershed processes.
- ❑ Managing growth and development to protect watershed processes and habitat conditions.

- ❑ Restoring passage at culverts and other artificial barriers.
- ❑ Restoring lowland floodplain function, riparian conditions, and stream habitat diversity.
- ❑ Addressing immediate risks with short term habitat fixes.
- ❑ Aligning hatchery priorities with conservation objectives.
- ❑ Reducing out-of-subbasin impacts.

### **Lower Columbia Tributaries**

This subbasin includes a series of small tributaries between the Lewis River and Bonneville Dam including Salmon, Lake, Duncan, Hardy, and Hamilton creeks. Salmon and Lake creeks have been heavily urbanized while the gorge tributaries are largely in forest lands. The urban streams will play a limited role in salmon recovery. Populations of fall chinook, winter steelhead, chum and coho in lower gorge tributaries will be important to recovery. Priority actions include:

- ❑ Restoring floodplain function, riparian conditions, and stream habitat diversity.
- ❑ Managing growth and development to protect watershed processes and habitat conditions.
- ❑ Managing forests pursuant to Forest and Fish Rules to restore watershed processes.
- ❑ Restoring passage at culverts and other artificial barriers.
- ❑ Addressing immediate risks with short term habitat fixes.
- ❑ Aligning hatchery priorities with conservation objectives.
- ❑ Reducing out-of-subbasin impacts.

### **Washougal Subbasin**

Fall chinook, chum, and summer steelhead need to be restored to a high level of viability and coho and winter steelhead that need to be restored to a medium level of viability. The subbasin is diverse with significant portions in

forest, agriculture, rural residential, and urban uses. Priority actions include:

- ❑ Protecting intact forests in headwaters.
- ❑ Managing forest land pursuant to Forest and Fish Rules to protect and restore watershed processes.
- ❑ Managing growth and development to protect watershed processes and habitat conditions.
- ❑ Restoring passage at culverts and other artificial barriers.
- ❑ Restoring lowland floodplain function, riparian conditions, and stream habitat diversity.
- ❑ Addressing immediate risks with short term habitat fixes.
- ❑ Aligning hatchery priorities with conservation objectives.
- ❑ Reducing out-of-subbasin impacts.

### Wind Subbasin

This subbasin historically supported abundant fall Chinook, winter steelhead, chum, and coho. Coho and summer steelhead need to be restored to a high level of viability to meet regional recovery objectives. Chum need to be restored to a medium level of viability. Priority actions include:

- ❑ Reducing out-of-subbasin impacts.
- ❑ Protecting intact forests in headwaters.
- ❑ Managing forest lands pursuant to Forest and Fish Rules and federal forest plans to protect watershed processes,
- ❑ Managing growth and development to protect watershed processes and habitat conditions.
- ❑ Restoring passage, floodplain function, riparian function, and stream habitat diversity in critical areas.
- ❑ Aligning hatchery priorities with conservation objectives.

### Little White Salmon Subbasin

This subbasin will play a limited role in salmon recovery but is significant for many

resident fish and wildlife species. A limited amount of habitat is available for anadromous fish and much of the historical habitat for fall chinook and chum salmon was inundated by Bonneville Reservoir. Priority actions include:

- ❑ Managing growth and development to protect watershed processes and habitat conditions.
- ❑ Restoring passage at culverts and other artificial barriers.
- ❑ Addressing immediate risks with short term habitat fixes.
- ❑ Aligning hatchery priorities with conservation objectives.
- ❑ Reducing out-of-subbasin impacts.

### Columbia Gorge Tributaries

This subbasin includes small tributaries between Bonneville Dam and the White Salmon River, of which Rock Creek is the largest. Gorge populations of coho salmon will need to be restored to a high level of viability and chum to a medium level of viability to meet regional recovery objectives. Priority actions include:

- ❑ Reducing out-of-subbasin impacts.
- ❑ Addressing immediate risks with short term habitat fixes.
- ❑ Managing forest lands pursuant to Forest and Fish Rules and federal forest plans to protect watershed processes.
- ❑ Managing growth and development to protect watershed processes and habitat conditions.

## ACKNOWLEDGMENTS

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